Data Log Definitions

Every Trackball supplied by Pretorian Technologies Ltd undergoes a rigorous test regime to ensure reliability and longevity. All products are tested at room temperature and in addition all products are burned in at maximum supply voltage and maximum operating temperature for 48 hours before final test and inspection.

Complex Automatic Test Equipment (ATE) forms the heart of the test strategy. This equipment has been designed by ourselves to exacting standards using microprocessor systems and leading edge test equipment.

This documents describes the tests that are performed and the resultant Data Log that is printed out by the ATE and supplied with every product. Additionally, a copy of the Data Log is maintained at the factory for all products.

Should a product ever be returned to us for repair or refit we can instantly recall the operating parameters of the product when it was shipped, allowing us to better understand potential modes of failure and enabling us to build a comprehensive database which forms part of our strategy of continuous improvement.

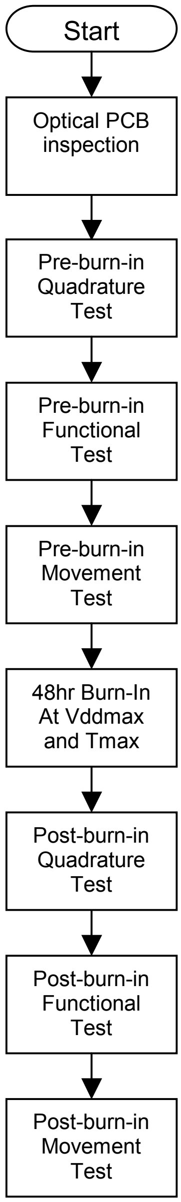

Figure 1: Test Flow Diagram

1. Test flow diagram.
The flow diagram shown in Figure 1 shows the test regime which is used on each product.

2. Data Log Summary

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>PRETORIAN TRACKBALL DATA LOG
>--------------------------------
>
>X PHASE ANGLES
>--------------------------------
>N      : 100
>STD DEV: 3.478,470 DEG
>MEAN   : 102.817,878 DEG
>MAX    : 121.911,41  DEG
>MIN    : 93.180,7  DEG
>
>Y PHASE ANGLES
>--------------------------------
>N      : 100
>STD DEV: 6.028,453 DEG
>MEAN   : 100.678,331 DEG
>MAX    : 113.815,27  DEG
>MIN    : 92.572,9  DEG
>
>TESTING PS2 COMS    PASS
>TESTING BUTTON L    PASS HIGH
>                    PASS LOW
>TESTING BUTTON M    PASS HIGH
>                    PASS LOW
>TESTING BUTTON R    PASS HIGH
>                    PASS LOW
>TESTING BUTTON 4    PASS HIGH
>                    PASS LOW
>TESTING BUTTON 5    PASS HIGH
>                    PASS LOW
>TESTING INPUT Z1    PASS HIGH
>                    PASS LOW
>TESTING INPUT Z2    PASS HIGH
>                    PASS LOW
>TESTING DIPSW 1     PASS
>TESTING DIPSW 2     PASS
>TESTING DIPSW 3     PASS
>TESTING DIPSW 4     PASS
>TESTING DIPSW 5     PASS
>TESTING DIPSW 6     PASS
>TESTING DIPSW 7     PASS
>TESTING DIPSW 8     PASS
>TESTING BUZZER      PASS
>TESTING LED1        PASS
>TESTING LED2        PASS
>TESTING RTS         PASS HIGH
>                    PASS LOW
>TESTING TX          PASS HIGH
>                    PASS LOW
>TESTING USB COMS    PASS
>
>--------------------------------
>UNIT PASSED
>--------------------------------
>
>
```

X Axis Phase
Quadrature Parametrics
See Section 3.1

Y Axis Phase
Quadrature Parametrics
See Section 3.1

PS/2 Communications
See Section 3.2

Button Tests
See Section 3.3

DIP Switch Tests
See Section 3.4

RS232 Communications
Tests. See Section 3.5

USB Communications
See Section 3.6

Overall Result
See Section 3.7

3. Individual Tests

3.1 X/Y Phase Quadrature Tests
A very high specification digital tester is used to perform these statistical tests on a sample of 100 phase quadrature cycles on each of the X and Y axes. The tester measures the phase angle of each cycle and, on completion, gives a statistical analysis of each phase. The axes are rotated at constant speed by a motorised assembly during this test.

The Data Log lists the statistical parameters shown in Table 1:

Sample size, N.	Always 100 cycles.
Mean value in degrees.	Ideally 90°
Maximum value in degrees.	Ideally 90°
Minimum value in degrees.	Ideally 90°
Standard deviation.	Ideally 0°

Table 1: Statistical Parameters

Whilst the mean value should ideally be 90°, a tolerance limit is given in the individual product data sheets. No product is shipped which has a mean phase angle outside of this limit.

Whilst no formal specification exists for the maximum, minimum and standard deviation, these data are used to determine any potential problems with the phase quadrature outputs. For example, if one slot of the rotor was distorted or partially obscured, this would lead to a maximum or minimum value which differs significantly from 90°. If a number of slots exhibited a problem, the standard deviation may be significantly over 0°.

By testing in this way, it is possible to quickly and accurately collate data on several complete revolutions of the rotor and gain a higher degree of confidence than is possible with traditional measurement techniques such as visual inspection on an oscilloscope or by moving a cursor.

3.2 PS/2 Communications.
The majority of the tests which are performed by the ATE use the PS/2 mode as the means of communication with the Trackball under test. It is therefore essential that the PS/2 communications channel be tested early in the test cycle.

During this test, the ATE sends out a sequence of valid PS/2 commands and checks for the correct responses from the Trackball. Only if all responses are correct and are sent within a determined period will this test pass.

3.3 Button Tests
Each of the button inputs is checked in turn by:

1. Allowing the pin to float and checking for a high on the associated processor pin (each has an internal pull-up resistor)
2. Pulling the pin low to simulate a button press and checking for a corresponding low on the processor.

Both of these tests must pass for the button to be registered as a pass overall. This test is repeated for each available button. Each test also checks the other buttons to ensure that there are no short circuits between adjacent tracks/ pads.

3.4 DIP Switch Tests
Each DIP Switch is tested in turn by manually toggling it on and back off again. A low and subsequent high on the corresponding processor pin constitutes a pass. Again, all DIP switch inputs are tested to ensure that there are no short circuits between adjacent tracks/ pads.

3.5 RS232 Communications.
The RS232 communications interface comprises two signals- Transmit output (Tx) and Request to Send input (RTS). The transmit output is tested to ensure that it is capable of outputting both a low and high output, and the RTS input is tested to ensure that both a low and high are recognisable at the corresponding processor pins.

3.6 USB Communications.
Whilst USB communications use the same pins and tracking as the PS/2 communications, it is important that the ATE confirms operation of the USB communications interface on the processor. The ATE performs a series of tests which confirm this.

During this test, the ATE operator also has the facility to perform a movement test where the Trackball is used to move the cursor in a standard Windows environment. This acts as a final confirmation that the unit is operating correctly before it is shipped.

3.7 Overall Result.
The overall result is shown at the end of the Data Log. A failure in any of the preceding tests constitutes and overall failure.